

EE

Contactless Meter Relays

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The contactless meter relay is a continuous reading meter with built-in control set points so that an alarm output, or control signal, is provided when the meter indication reaches a preset control point. Meter relays of this type, as in Figure 1, have many industrial applications as system monitors where, for example, they continuously monitor critical current or voltages to provide an alarm or a control signal when the limits are exceeded. They can also be used directly as controllers as where the control parameter is converted into a con-

light beam to the sensor at the set point. Normally light falls upon each of the photo-conductors when the meter pointer is between the set points. Current input causes the meter pointer to move with the flag which will interrupt the light to one of the photo-conductors at the set point. This causes a photo-conductor change in resistance triggering a solid-state switch which in turn drives the output relay. The light source is operated below its rating for a long trouble-free life.

The meter relay has no electrical contacts except the

CONTACTLESS METER RELAYS

For applications requiring maximum reliability and where little power is available for signal circuits

venient input to the meter and the meter relay outputs provide control signals.

Any required electrical quantity can be measured by the meter. At the same time, it is possible to originate a signal when the meter pointer passes the control points by using optically controlled contacts. Both the indications and the switching are done completely independent from each other.

This relay is ideal for the use of controlling and switching any electrical value which can be measured by D'Arsonval movements or anything which can be transformed into an electrical unit by means of transducers, i.e. direct voltage, direct current, AC volts, AC current, RPM, temperature, expanded scale values for AC or DC, frequency, level, illumination and others.

Figure 2 shows the contactless meter relay block diagram. Contactless relays are designed for applications where operation on a small amount of power is necessary or where extreme reliability is required. In addition to the meter movement, there is a light source and a pair of photo-conductors. The meter relays thus have four basic elements which include; (1) a D'Arsonval meter, (2) a light source, (3) one or two photo-conductive cells, (one for each set point), and (4) a mechanism for control of the light between the source and the photo cells.

Construction of a typical unit is shown in Figure 3. The meter movement has a flag which moves with the meter pointer in such a way that the flag interrupts the



Fig. 1. A cad-plated steel cover encloses the network

output and no moving parts except the basic movement with its attached flag. The meter relay can be built with a single set or with a pair of set points, where one is an upper limit and the other is a lower limit.

Figure 4 is a basic circuit arrangement showing a DPDT output. Consider this as a control meter relay. In the position of the relay as shown, lamp A and lamp C which are external loads will be lighted by energy source E. When the input to the relay is sufficient to cause a closure of the output relay, switching will occur which will deenergize lamps A and C and energize lamps B and D. It is possible to use various types of devices rather than the lamps as shown as long as the load is within the contact rating of the relays. It is possible to provide switching at the input so that any number of individual voltages can be tested in sequence of speeds up to ten per second.

Circuit details may be seen from Figure 5. The electronic switching circuit, which picks up the difference of the sensor resistivity between the illuminated and dark sensor condition is an emitter controlled transistor switching circuit. With light on the cell, its resistance is relatively low. Since the cell and R_1 form a voltage divider, changes in cell resistance change the base voltage of TR 1.

When the voltage between point A and B is lower than the voltage between C and B, the base-emitter junction of the first stage transistor is reversed biased and no



Fig. 2. Block diagram of Simpson Contactless Meter Relay

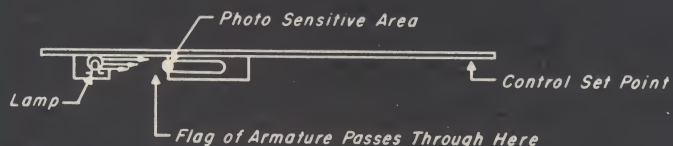


Fig. 6. Carrier assembly contains a lamp and the sensor

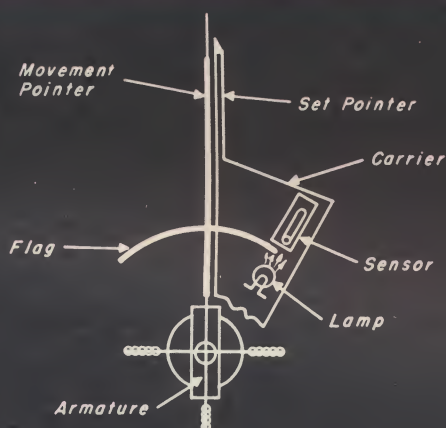


Fig. 3. Construction of meter relay shows optics and flag

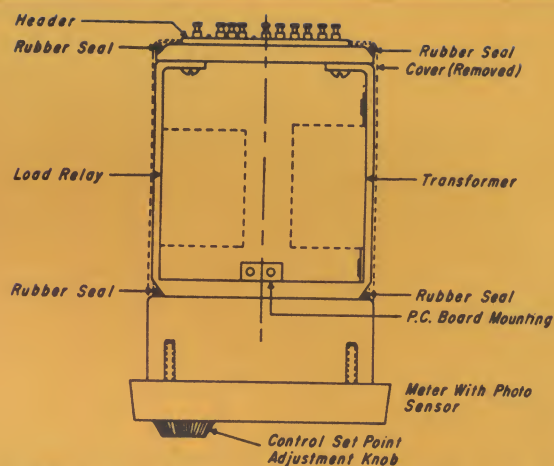


Fig. 7. This network assembly includes a 3PDT load relay

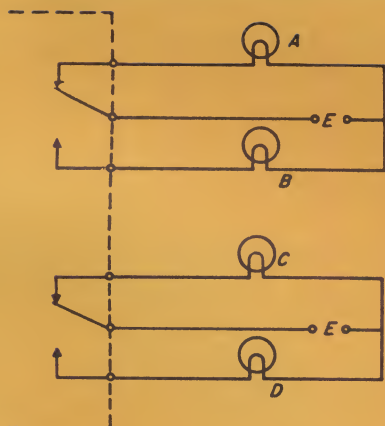


Fig. 4. Basic control circuit of Contactless meter relay

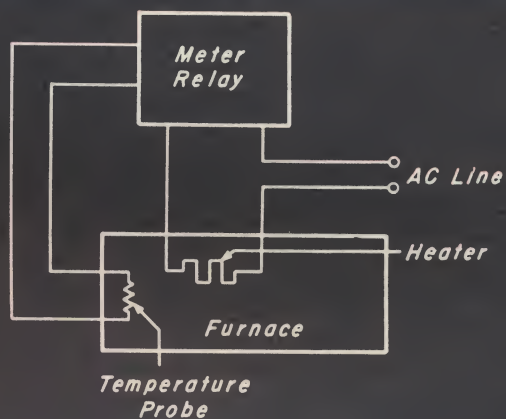


Fig. 8. Heater control system uses contactless meter relay

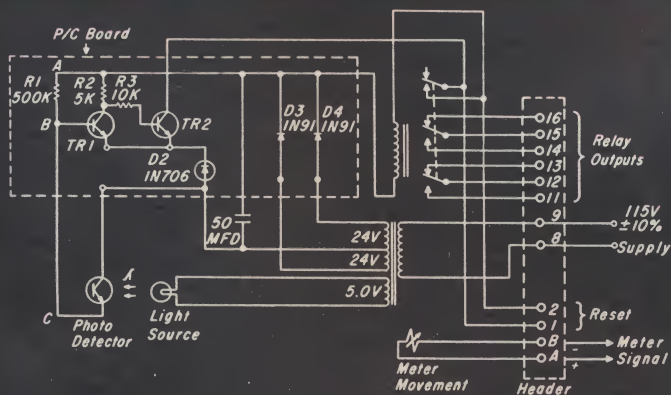


Fig. 5. Switching circuit employs Zener reference diode

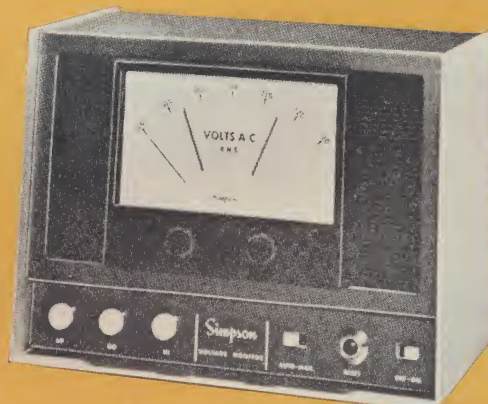


Fig. 9. Monitor triggers alarm and indicates voltage

current will flow through transistor 1. This applies forward bias to the second stage, providing collector current for energizing the load relay. With the light blocked off by the flag of the movement, the first stage is forward biased. The additional current drawn by the collector of TR 1 drops the voltage at D, thus reverse biasing TR 2. This cuts off the collector current on TR 2, de-energizing the load relay.

In the self-contained, single contact meter relay, a special power transformer supplies the necessary voltages for the transistor circuit, as well as for the lamp. Two diodes are used in a full wave rectifier circuit to supply the necessary DC voltage for the electronic circuit and relay.

On the dual contact meter relay, the self-contained unit has, in place of the transformer, a second load relay. Power to relays, lamps and the electronic circuit is supplied by an external power supply which connects directly to the header of the unit.

There are 12 active terminals on the header; A and B are the meter signal input, while 8 and 9 are the single control point power input of 115 volts AC, $\pm 10\%$, at 50 to 500 cps. Terminals 1 and 2 are reset with a jumper from 1 to 2 for automatic reset, without the jumper a manual reset is used. Terminals 11 through 16 are the relay output. Where the meter pointer is below the set point there are jumpers from 11 to 12 and 14 to 15. Where the meter pointer is above the set point there are jumpers from 12 to 13 and 15 to 16.

The lamp and photo sensor are placed on a carrier as shown in Figure 6. The carrier also has a gear segment which rotates around the pivot point of the actual movement center. The gear segment engages into an idler gear mounted on a mask which also fastens to the carrier. The idler gear is engaged to a driver which has, on the other end of the shaft, the external adjustment knob. The use of an idler gear in the assembly made it possible to have clockwise movement of the contact set points with a clockwise rotation of the adjustment knobs on the front of the meter.

A printed circuit board is used for the wiring of the electronic circuit. It takes all the components shown in Figure 5, except the transformer. Two P.C. boards of the same design are used for the double control set point meter relay to accommodate the circuit components of the low and high limit points.

Figure 7 shows a typical meter network assembly with the actual meter and the different assemblies to make the meter completely self-contained. On the back of the meter case, which is a one piece drawn steel case, a support bracket is riveted. This bracket mounts all the necessary components. The power transformer mounts on one leg of the support, the load relay on the other. On the lower side of the support bracket, two ears are bent up for the mounting of the printed circuit boards. The top side of the support legs are bent 90° and allow the custom molded header to be mounted to the whole

assembly. The same type header with the same number sequence is used for the double contact meter relay. Also on special relays, two or three different ranges can be handled with the same header.

For a double contact type relay, only one change in the assembly shown in Figure 7 is necessary. In place of the small power transformer, the load relay for the second contact point is mounted. This becomes a completely self-contained double contact point meter relay, because all important and necessary assemblies which execute the control action are together as one final part.

The load relay is a high reliability unit with three sets of double throw contacts (3PDT). Two sets (DPDT) of the contacts are brought to the header terminals, making it possible for any external circuit to either open or close with the coincidence of movement pointer and control set pointer. The other set is used on all standard units to provide each set point with the automatic/manual reset feature. The contact rating is 10A at 115 VAC or 32 VDC non-inductive load for each set of contacts.

The contactless meter relay can be considered as a controller with an upper limit set point and a lower limit set point. Controllers may also be indicators; they may be sub-systems or complete control systems as in Figure 8. This is for controlling temperature in a furnace where exact control of melting points is extremely important. In this application the input signal for the unit was obtained from a thermocouple and its output controlled the line power to the heater. The temperature signal is derived from the temperature-sensitive element or probe as compared with the pre-set upper and lower limits. When the load temperature is equal to the upper temperature limit, the meter relay opens line power to the heater. When the measured temperature drops to the lower limit, line power is again applied.

In addition to zone control, contactless relays are also readily adapted to the proportioning control systems as well as to the alarm systems. The standard contactless relays can be used as monitors such as the Voltage Monitor in Figure 9. This can be used to monitor line voltage for a critical application and, as shown in the illustration, the lower set point is 107.5 volts while the upper set point is 123.0 volts. In operation the voltage monitor will continuously indicate the line voltage and an alarm will be triggered if the line voltage falls below 107.5 volts or rises above 123.0 volts. The circuit may be arranged to lock in position when either of the set points is reached, and in this case manual resetting is required. It is possible to arrange the instrument so that automatic resetting occurs and the instrument does not lock up at either the upper or lower limit.

This obviously makes the contactless relay ideal for applications requiring maximum reliability, where rough service or extremely unfavorable environments would be encountered or where very little power is available for the signal circuit.

Simpson

WORLD'S LARGEST MANUFACTURER
OF ELECTRONIC TEST EQUIPMENT



Contactless Meter Relays — Model 3324XA

The standard stock unit is the contactless panel meter relay model 3324XA with a 4 inch meter face. Standard units include four DC microammeters, one DC milliammeter and one DC millivolt meter. Special meter relays can be obtained with other full-scale readings and with 3-1/2 inch and 6 inch meters.

SPECIFICATIONS	
Calibration accuracy:	± 2% of full scale
Control point adjustment:	
Single control point:	100%
Double control point low limit:	0-95%
Double control point high limit:	5-100%
Control point adjustment within each other:	5°
Control point differential between off/on:	.5% of full scale
Control point indication:	± 1% of actual switching
Power requirement:	115 VAC, ± 10%, 50-500 cps
Control circuit:	Fail safe, relay opens in event of power failure
Output:	DPDT, 10A non-inductive load at 115 VAC or 32 VDC for each control point.
Meter indication:	Continuous, unaffected by control point setting.
Reset:	Automatic or Manual
Single Control Meters:	One DPDT relay, integral power supply
Double Control Meters:	Two DPDT relays, separate power supply module

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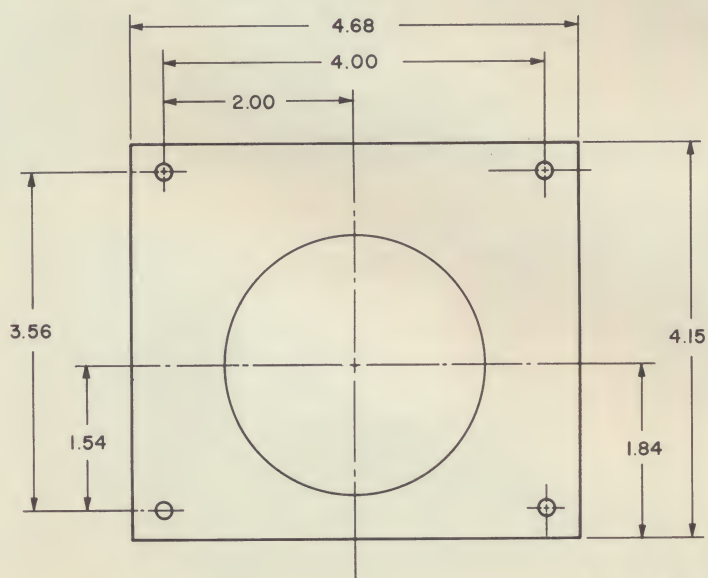
Power requirements are 115 volts AC $\pm 10\%$, 50-500 CPS. The power supply provides all DC power required for sensing and switching. For single controls the power supply is self-contained. An external power module is furnished with the double control units. The power supply module is 2.4 x 2.4 x 1.94 inches. Maximum power drain is 3 VA for the double control unit.

RANGE	SINGLE CONTROL			DOUBLE CONTROL	
	R*	Cat. No.	Price	Cat. No.	Price
DC Microammeters					
0-50	3000	16451	\$90.00	16470	\$123.90
0-100	1300	16452	87.30	16471	121.50
0-200	570	16453	87.30	16472	121.20
0-500	220	16454	87.30	16473	121.20
DC Milliammeter					
0-1	80	16455	86.40	16474	120.30
DC Millivoltmeter					
0-50	10	16460	86.70	16480	120.75

*Approx. resistance in ohms

Relay Adjust Button

.75 Dia. Protruding .18 Above Bezel, Located .97 Below Meter Center Line, And .98 Left And/Or Right Of The Meter Center Line As Applicable.



#6-32 NC-2
4 STUDS

